CLAIMS

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

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1. A method for detecting molecules, the method comprising:

a) determining the electronic status of a semi-conductor;

b) establishing electronic communication between the molecules and the semiconductor;

c) subjecting the semi-conductor to energy influx;

d) redetermining the electronic status of the semi-conductor.

2. The method as recited in claim 1, wherein the energy level is determined optically.

3. The method as recited in claim 1, wherein the energy level is determined electrically.

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10 ~~4.~~ The method as recited in claim 1, wherein the semiconductors are are octahedral metal oxides.

4 ~~5.~~ The method as recited in claim 1, wherein the semiconductors are metal oxides selected from the group consisting of TiO_2, VO_2, ZrO_2, Fe_3O_4, MnO_2, NiO, CuO, and combinations thereof.

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5 ~~6~~. The method as recited in claim 1 wherein bidentate moieties are positioned intermediate the molecules and the semiconductors.

14 ~~7~~. The method as recited in claim 6, wherein the moieties are dihydroxyl phenyls selected from the group consisting of 1,2 dihydroxyl phenylamine, 1,2-dihydroxyl phenyl alanine, 1,2-dihydroxyl benzoic acid, 1,2-dihydroxy glycine, 1,2 dihydroxy benzyl amine, and combinations thereof.

6 ~~8~~. The method as recited in claim 1, wherein the semiconductor further comprises a valence band and a conductive band, whereby the valence band contains electrons.

7 ~~9~~. The method as recited in claim 6 ~~8~~, wherein the energy influx induces the electrons to relocate to the conductance band.

8 ~~10~~. The method as recited in claim 1 wherein the molecules are electron donators.

9 ~~11~~. The method as recited in claim 1 wherein the molecules are electron acceptors.

15 ~~12~~. A method for detecting biological molecules, the method comprising:

a) supplying a semi-conductor having a first energy level and a second energy level and whereby the first energy level corresponds to a first optical characteristic of the semi-conductor;

b) establishing electrical contact between the semi-conductor and the molecules;

c) causing electrons to move from the molecule to the second energy

level, and

d) monitoring any change in the first optical characteristic.

14 ~~13~~. The method as recited in claim 15 ~~12~~, wherein the biological molecule extracts electrons from the semi-conductor.

17 ~~14~~. The method as recited in claim 15 ~~12~~, wherein the biological molecule donates electrons to the semi-conductor.

18 ~~15~~. The method as recited in claim 15 ~~12~~, wherein a bidentate moiety is intermediate the semi-conductor and the biological molecule.

19 ~~16~~. The method as recited in claim 15 ~~12~~ wherein a moiety capable of withdrawing electrons from the biological molecule is in electrical communication with the molecule.

20 ~~17~~. The method as recited in claim 15 ~~12~~ wherein a moiety capable of donating electrons to the biological molecule is in electrical communication with the molecule.

23 ~~18~~. The method as recited in claim 12 wherein the semiconductors are octahedral metal oxides.

21 ~~19~~. The method as recited in claim 15 ~~12~~, wherein the semi-conductor is between 1 and 20 nanometers in diameter.

22 ~~20~~. The method as recited in claim 15 ~~12~~ wherein the step of causing electrons to move results in the formation of an oxidative region on the semi-conductor.

28 ~~21~~. The method as recited in claim 20, wherein the oxidative region facilitates cleavage of molecules.

29 ~~22~~. A method for detecting target moieties *in situ*, the method comprising:

a) binding biological material to nanocrystalline semiconductor particles, wherein the material has an affinity to the target moiety;

b) facilitating entry of the bound material into an organelle; and

c) subjecting the semiconductor to radiation sufficient to produce a charge pair separation on the semiconductor's surface.

30 ~~23~~. The method as recited in claim 29 ~~22~~ wherein the biological material is genetic material.

31 ~~24~~. The method as recited in claim 29 ~~22~~ wherein the organelle is a nucleus of a cell.

32 ~~25~~. The method as recited in claim 29 ~~22~~ wherein the charge pair separation is detected via Electron Paramagnetic Resonance.

33 ~~26~~. The method as recited in claim 29 ~~22~~ wherein the charge separation is detected via an electronic signal.

34 ~~27~~. The method as recited in claim 33 ~~26~~ wherein the signal can be amplified.

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